

A Reaction Sphere for High Performance Attitude Control, Phase I

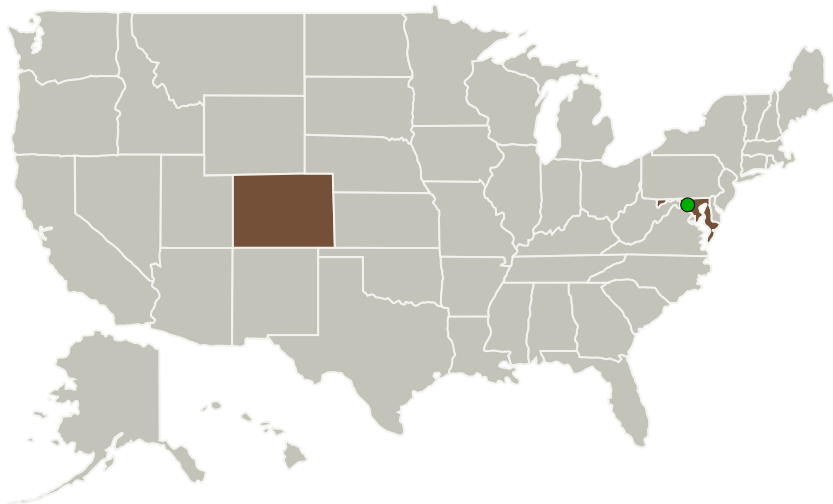
Completed Technology Project (2011 - 2011)



Project Introduction

Our innovative reaction sphere (Doty pending patent application serial number 61/164,868) has the potential to provide much higher performance than a conventional reaction wheel with substantially fewer resources. Using our proposed technology, a single reaction sphere can control three axes, substantially reducing mass, power, and cost when compared to a three wheel system. This device has no bearings: its spherical rotor is suspended within the stator by magnetic forces. Magnetic suspension reduces jitter, especially in a station-keeping mode where the torque and suspension forces can be reduced to a minimum. With clearances of ~ 1 mm and no critical balance requirements, this device has very loose mechanical tolerances, further reducing cost. For initial development we propose a version suitable for control of a 1-3 kg Cubesat. At this scale, where spacecraft moments of inertia are very small, our low jitter torque, simplicity, and low cost are most advantageous. We also believe this approach is most likely to lead to an early flight opportunity.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
NOQSI Aerospace, Ltd	Lead Organization	Industry	Pine, Colorado
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Colorado	Maryland

Project Transitions

▶ **February 2011:** Project Start

✓ **September 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137921>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

NOQSI Aerospace, Ltd

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

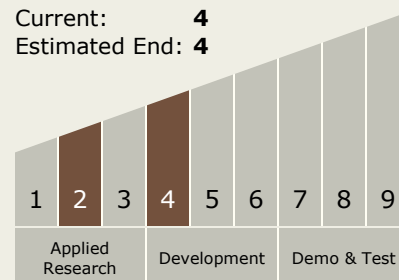
Carlos Torrez

Principal Investigator:

John P Doty

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



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Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
 - └ TX17.3 Control Technologies
 - └ TX17.3.4 Control Force/Torque Actuators

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System